Space Weather Forecast

Issued on Saturday, 16 September 2023 at 13:04 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Large CME observed, modelling awaited. Moderate Geomagnetic Storm G2 Likely late UTC day of Saturday into Sunday. Chance of Minor G1 Monday. Chance R1 Minor Radio Blackouts throughout.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Moderate in the past 24 hours, with a trio of X-ray flares from an active sunspot group near the middle of the Sun. These flares were successively larger in magnitude, peaking at 16/0538UTC. There were up to seven sunspot regions on the facing side, with signs of an arriving region in the far east as another begins its departure in the far west. The past 24 hours' activity is thought to largely be the work of a particularly unstable magnetic configuration in the central sunspot group. Other sunspots on the Sun were largely unremarkable, although the new eastern arrival did produce a mid-ranking Common-class flare to perhaps hint at a degree of potential here.

The large 'filament' (arc of plasma) mentioned in Friday's guidance that previously dominated the central-north part of the Sun was seen to finally leave in the current UTC morning, perhaps destabilised by the suite of Moderate-class flares from its unruly southern sunspot group neighbour. Imagery of this Coronal Mass Ejection (CME) beyond very close-in satellite frames is not yet available to ascertain any trajectory, however it is liekly to bear an Earth-directed component. There was no significant X-ray flare associated, and the emission appears slow, however very tentatively a large CME appears likely to feature late in the current four-day period - to be more fully determined as imagery allows.

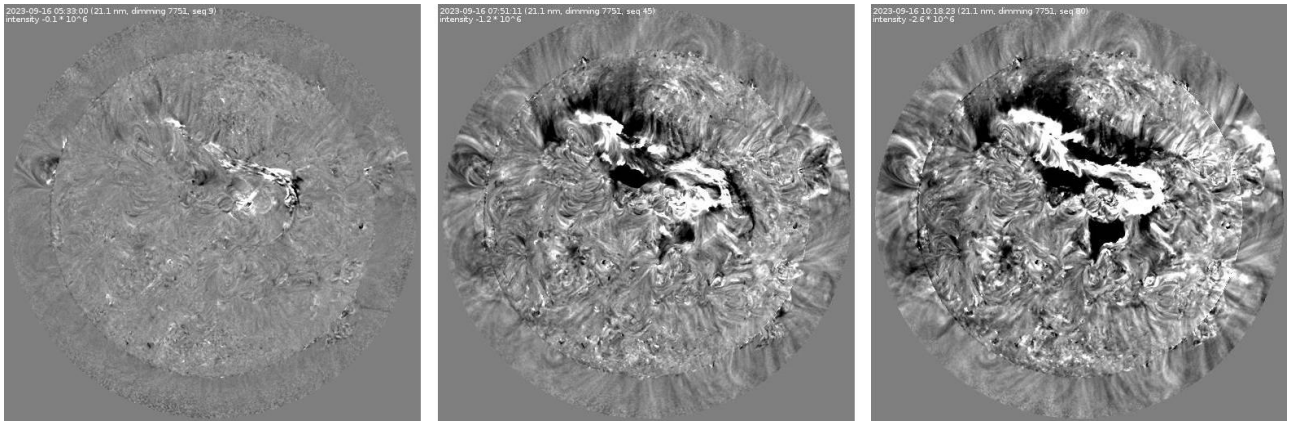

Figure 1: SIDC ROB extreme UV time-integrated view of the large central filament eruption of the current UTC morning. This is now appearing in satellite imagery and will be analysed shortly. The ejecta appears to be on and ahead of the Sun-Earth line from early impressions.

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The only other CME visible in the period was a high-latitude feature apparently heading northeast. There is no obvious front-sided source and this is perhaps far-sided, although full analysis has yet to be conducted. No other CMEs were observed in the past 24 hours.

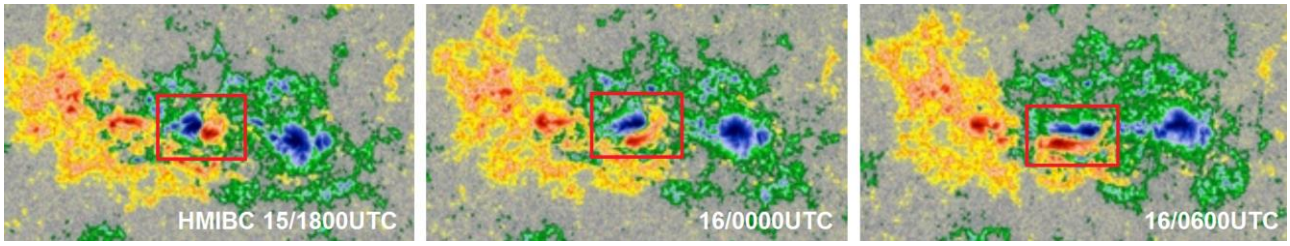
Solar Wind / Geomagnetic Activity: Solar wind parameters are perhaps now thought most likely to be explained as the fast wind from a 'coronal hole', with a possible onset having occurred on Thursday 14 September. This is not a conclusive diagnosis, and there is a small chance of a fast wind arriving within the current UTC day, however this now appears unlikely.

The solar wind speed fell slightly within slightly elevated levels in the period. The number of particles in the solar wind was level within its typical background range, while the associated magnetic field was smooth and steady at background levels, with no prolonged co- or anti-aligned periods with Earth's field.

The net result of the above solar wind measures was for provisionally mostly quiet geomagnetic activity.

Energetic Particles / Solar Radiation: No solar radiation storms were observed.

Figure 2: Magnetic satellite imagery sequence (HMIBC) of movement in the central spot in the most active sunspot region in the UTC overnight period. Note the relativey rapid change in configuration within the red boxed region, which is likely to have helped generated the Moderate-class X-ray flares through this time interval.



Four-Day Space Weather Forecast Summary

Solar Activity: There is a daily chance of Moderate-class X-ray flares, mainly from the complex sunspot group near the middle of the Sun. A group on the western solar horizon should leave the Earth-facing side over the current UTC weekend, but the flare risk may be maintained by the return of another group in the east.

Solar Wind / Geomagnetic Activity: The geomagnetic forecast is of lower than average confidence. The large 'filament eruption' CME of the current UTC day is awaiting imagery and does not yet feature. Therefore, the main forecast elements are the 14/0745UTC CME (especially), and to a lesser extent the 14/2126UTC CME.

Quiet initial conditions will likely evolve to G2 Moderate Geomagnetic Storm within the next 24 hours, receding into the new working week to be replaced by a further chance of G1 Minor Geomagnetic Storm during Monday morning UTC. Conditions provisionally then return to quiet to round out the period, however, note the filament awaiting analysis may maintain activity.

Energetic Particles / Solar Radiation: No solar radiation storms are expected, with a daily Slight Chance of an enhancement should any larger flares occur.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	60	40	50	10
Strong	G3	No	10	10	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	50	50	50	50
Very Active	R3 to R5 X	No	10	10	10	10

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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